

Technical University of Denmark



Laser ablation of lysozyme with UV, visible and infrared femto- and nanosecond pulses

Schou, Jørgen; Canulescu, Stela; Matei, Andreea; Cazzaniga, Andrea Carlo; Constantinescu, Catalin; Amoruso, S.; Wang, X.; Bruzzese, R.; Dinescu, M.

Publication date:
2013

[Link back to DTU Orbit](#)

Citation (APA):

Schou, J., Canulescu, S., Matei, A., Cazzaniga, A. C., Constantinescu, C., Amoruso, S., ... Dinescu, M. (2013). Laser ablation of lysozyme with UV, visible and infrared femto- and nanosecond pulses. Abstract from 12th International Conference on Laser Ablation (COLA 2013), Ischia, Italy.

DTU Library

Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Laser ablation of the protein lysozyme with pulses in the UV, visible and infrared regime by nanosecond and femtosecond lasers.

J. Schou^{1*}, S. Canulescu¹, A. Matei¹, A. Cazzaniga¹, C. Constantinescu¹, S. Amoroso², X. Wang²,
R. Bruzzese², M. Dinescu³

- 1) DTU Fotonik, Technical University of Denmark, Risø Campus, DK-4000 Roskilde, Denmark 1, Institute 1,
 - 2) Coherentia CNR-INFM and Dipartimento di Scienze Fisiche, Università Napoli Federico II, I-80126 Napoli, Italy
 - 3) National Institute for Lasers, Plasma and Radiation Physics, RO-077125 Magurele-Bucharest, Romania
- *corresponding author; josc@fotonik.dtu.dk, Phone: +45-46774755, fax: +45-46774565 .

Lysozyme is an interesting molecule for laser ablation of organic materials, because the ablation has been comprehensively studied, it is a medium heavy molecule with a mass of 14305 Da, which can be detected by standard techniques, and because it is used as a bactericidal protein in the food industry. Lysozyme molecules do not absorb energy for wavelengths above 310 nm, but nevertheless there is a strong mass loss by ablation for laser irradiation in the visible regime. The total ablation yield of lysozyme at 355 nm and at 2 J/cm² is about 155 µg/pulse, possibly one of the highest ablation yields ever measured. The mass loss is mainly caused by fragmentation of the lysozyme into simple gases, such as H₂S, H₂O and CO₂, which are rapidly pumped away in the vacuum chamber.

We have investigated the mass loss by ablation of lysozyme in all regimes to see whether a similar mechanism governs the ablation process for different wavelengths and time duration. Measurements for 6-7-ns laser ablation were carried out at DTU on Risø Campus, while measurements with pulses of 300 fs were carried out at the University of Naples in a similar setup. For all wavelengths except at nanosecond laser pulses at 355 nm, the efficiency of ablation is similar, about 0.02 g/J. Material deposited as films was investigated by MALDI (Matrix Assisted Laser Desorption) in order to check whether or not intact lysozyme molecules were transferred from target to the substrate. The experiments have confirmed that fragmentation of lysozyme into gases via photothermal processes drives the ablation at most wavelengths.